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Wallace, C.S. (2004). An illumination of the roles of hands-on activities, discussion, text reading, and writing in constructing biology knowledge in seventh grade. *School Science and Mathematics*, 104(2), 70-78.

This study by Wallace at the University of Georgia was meant to help researchers and teachers understand how students utilized a variety of sources when learning topics in a biology classroom. One of the tools used in this study was the Science Writing Heuristic (SWH) which is a tool used to generate teacher and student activities in order to promote the understanding of laboratory activities through social constructivist means. The SWH suggests that personal writing, group writing, group discussion, and concept mapping may accompany laboratory activities and help increase student understanding of the topics being covered. The student SWH template included guiding questions for learning in order to give the students an opportunity to write reflections on how their findings during laboratory activities compare with authoritative information and on what they have learned from the lab experience. In order to determine which methods of learning (textbook, lab activities, writing to learn or SWH) were most beneficial to students, the researcher developed this study.

There were 3 main research questions developed for this study, including (a) What sources of knowledge were most useful to students in creating biology explanations? (b) Which cognitive mechanisms did students identify as helping them construct biology understanding? (c) How do students’ written biology explanations fit the evidence from students about their own learning? In order to study these questions, the researcher conducted a study involving a 7th grade life science class at a Midwestern, suburban middle school. 6 students were chosen to participate in the study based on balanced gender, balanced levels of scientific achievement as indicated by course grades, a variety of learning strategies, and willingness to volunteer. Data were collected on each of these students including pre and post tests, SWH lab report sheets, and an interview with the students to get their personal input on which methods worked best for them.

The results of the study indicated that students who were able to integrate many different sources of knowledge, including textbook reading, laboratory activities, and writing-to-learn activities, were the most successful at understanding and being able to apply the knowledge they have learned. The two students who utilized almost all of the available sources of knowledge were able to readily relate scientific explanations with their own laboratory observations to create detailed, accurate, and authentic understandings of the topic being covered for that unit. The results also indicated that students use sources of knowledge that most closely match their personal epistemologies.

The findings of this study are incredibly important to my content area because I will be teaching in a biology classroom, which is the setting where this study was performed. The study showed how writing-to-learn activities, such as the ones we have discussed in class, play a significant role in helping the students understand scientific topics at a more cognitive level rather than just memorizing facts. The findings also showed that students tend to utilize information that matches their personal epistemologies, so it will be important to know the approaches each student takes to learning and try to find ways to integrate other sources of knowledge into their personal learning styles so that they can benefit from having as many different informational sources and instructional methods as possible.

The results of this study are very informative and will affect the different teaching methods I use in the biology classroom. According to the study, students learn best when they utilize multiple sources of knowledge, including writing activities such as writing-to-learn or answering questions on lab reports. In order to provide students with the best possible educational experience, I will try to incorporate writing activities frequently throughout my unit plans. I will also incorporate other information sources including textbook reading and hands-on lab activities. By doing this, I hope to give the students different viewpoints of the topics being studied so that they will be able to use higher-level thinking to have a more in-depth understanding of the information. Some specific examples that I will try to incorporate into my daily lessons are short journal entries that allow the students to think and write about the topics they are learning about and utilizing anticipation guides before the students read selections from the text or other sources so that they put more thought into their reading and learning. The study also found that students tend to utilize information sources that correspond with their personal epistemologies. This could cause some students to miss out on information that would be presented in a manner they don’t usually utilize. In order to alleviate this problem, I will try to present numerous different sources of information to the students during class instruction and I will also try to incorporate underused sources of information into sources that the students are already using, such as by having the students watch a video or read a text selection during lab activities.